

IN THE SPECIFICATION

Please replace the paragraph at page 1, prenumbered lines 10-19, with the following rewritten paragraph:

Conventionally, to measure a three-dimensional shape of an object (subject) has been demanded in various fields such as survey of land/building, production of CAD model, display of products/goods in on-line shopping, and so forth. As one of such [[a]] three-dimensional shape measuring methods, there is a method by which a pattern light is irradiated/projected onto an object, a picture of distortion occurring in the pattern on the object is taken, and, thus, shape measurement is performed.

Please replace the paragraph at page 3, prenumbered line 18, to page 4, prenumbered line 2, with the following rewritten paragraph:

The present invention has been devised in order to solve these problems, and, an object of the present invention is to achieve measurement of three-dimensional shape at high accuracy which can be used in various conditions, and, to provide a shape measurement system and a picture taking device which are as a whole miniaturized and inexpensive, the shape measurement method, and a recording medium in which a ~~software~~^{4e} software program for performing the shape measurements method is recorded.

Please replace the paragraph at page 4, prenumbered line 19, to page 5, prenumbered line 3, with the following rewritten paragraph:

a three-dimensional shape composing part expressing the each point by a coordinate in a single coordinate system and generating a composite image in accordance with at least two three-dimensional coordinates calculated for the each point by the three-dimensional coordinate calculating part based on respective images obtained as a result of a picture of the

subject on which the light having the predetermined pattern is applied being taken from at least two different positions.

Please replace the paragraph at page 5, prenumbered line 23, to page 6, prenumbered line 4, with the following rewritten paragraph:

The shape measurement system may further comprise an interpolation part performing interpolation processing on at least one of the ~~image~~ images obtained by the picture taking part and the composite image obtained by the three-dimensional shape composing part. Thereby, it is possible to obtain a three-dimensional shape at a higher accuracy.

Please replace the paragraph at page 9, prenumbered lines 5-14, with the following rewritten paragraph:

a three-dimensional shape composing part expressing the each point by a coordinate in a single coordinate system and generating a composite image in accordance with at least two three-dimensional coordinates calculated for the each point by the three-dimensional coordinate calculating part based on respective images obtained as a result of the picture of the subject on which the light having the predetermined pattern is applied being taken from at least two different positions.

Please replace the paragraph at page 11, prenumbered lines 17-24, with the following rewritten paragraph:

d) expressing the each point by a coordinate in a single coordinate system in accordance with at least two three-dimensional coordinates calculated for each point in the step c) based on respective images obtained as a result of the picture of the subject on which

the light having the predetermined pattern is applied being taken from at least two different positions in the step a).

Please replace the paragraph at page 13, prenumbered lines 3-9, with the following rewritten paragraph:

d) calculating a three-dimensional coordinate of each point of the subject for each image in accordance with a plurality of images obtained as a result of pictures of the subject on which the light ~~[[of]]~~ having the predetermined pattern is applied being taken by the plurality of picture taking parts, and the position information generated in the step c); and

Please replace the paragraph at page 14, prenumbered lines 1-6, with the following rewritten paragraph:

calculate a three-dimensional coordinate of each point of the subject in accordance with an image obtained as a result of the picture of the subject on which light having a predetermined pattern is applied being taken and position information specifying a position at which the picture of the subject is thus taken; and

Please replace the paragraph at page 14, prenumbered lines 7-13, with the following rewritten paragraph:

express the each point by a coordinate in a single coordinate system in accordance with at least two three-dimensional coordinates calculated for the each point based on respective images obtained as a result of the picture of the subject on which the light having the predetermined pattern is applied being taken from at least two different positions.

Please replace the paragraph at page 15, prenumbered lines 1-3, with the following rewritten paragraph:

a ~~magnetic~~ magnetic sensor to generate the position information specifying the position with respect to terrestrial magnetism.

Please replace the paragraph at page 15, prenumbered lines 8-16, with the following rewritten paragraph:

The program may further cause the computer to generate a three-dimensional image of the subject in accordance with the coordinates of the subject in the single coordinate system, and an image of the subject obtained through taking the picture of the subject but on which the light having the predetermined pattern is not applied. Thereby, it is possible to generate a three-dimensional reproduced image which is faithful to the subject even for a pattern or the like provided on the subject.

Please replace the paragraph at page 15, prenumbered line 22, to page 16, line 5, with the following rewritten paragraph:

calculate a three-dimensional coordinate of each point of the subject for each image in accordance with a plurality of images obtained as a result of pictures of the subject on which the light ~~[[of]]~~ having the predetermined pattern is applied being taken by the plurality of picture taking parts, and the position information specifying positions at which the pictures of the subject are taken by the plurality of picture taking parts; and

Please replace the paragraph at page 21, prenumbered lines 6-14, with the following rewritten paragraph:

The attitude detecting part 16 detects attitude (picture taking position, picture taking angle and so forth) of the shape measurement system 1 at an occasion of taking a picture of the subject. The above-mentioned attitude is detected each time a picture is taken by the system 1. Information such as the above-mentioned picture taking position, picture taking angle and so forth may be absolute $[[one]]$, or may be relative $[[one]]$ with respect to a viewpoint.

Please replace the paragraph at page 22, prenumbered lines 5-15, with the following rewritten paragraph:

Operation performed by the above-mentioned shape measurement system 1 will now be described in detail with reference to FIG. 3. In a step S1, it is determined whether or not a user gives instructions of taking a picture. When instructions of taking a picture are given, a step S2 is performed. When no instructions of taking a picture are given, such instructions are waited for by the system 1 in step S4. At this occasion, as a result of a release button (manual button) being pressed by the user at a first viewpoint, the step S2 is performed, and a picture of the subject is taken.

Please replace the paragraph at page 24, prenumbered lines 1-2, with the following rewritten paragraph:

(P_x, P_y, P_z) denotes a vector 23 representing a direction in which the pattern light is applied;

Please replace the paragraph at page 24, prenumbered lines 9-11, with the following rewritten paragraph:

d denotes the distance between the pattern light irradiating part 14 and the optical center 25 of the above-mentioned picture taking optical system.

Please replace the paragraph at page 24, prenumbered lines 12-23, with the following rewritten paragraph:

Then, a picture of the subject is taken again from a second viewpoint other than the above-mentioned first viewpoint similarly to the above-mentioned operation. Then, based on a thus-obtained image, the three-dimensional coordinates of points on the surface of the subject are calculated similarly to the above-mentioned operation. The operation of taking a picture from the second viewpoint is performed in a manner such that at least some points on the surface of the subject taken from the first viewpoint are included in the image obtained in the operation of taking a picture from the second viewpoint.

Please replace the paragraph at page 24, prenumbered line 24, to page 25, line 3, with the following rewritten paragraph:

Then, after a picture of the subject 20 is taken from a plurality of viewpoints as mentioned above, a step [[S5]] S4 is performed for finishing taking picture of the same subject 20, but the step S1 is performed again for continuing taking picture of the same subject 20.

Please replace the paragraph at page 35, prenumbered line 22, to page 36, prenumbered line 8, with the following rewritten paragraph:

As shown in FIGS. 7B and 7C, depending on the direction of picture taking, a side surface, a rear surface, a top surface, or a bottom surface of the subject 20 becomes a blind spot for the picture taking operation, for example. Thereby, it may not be possible to specify a shape of the subject 20 from each group of the thus-obtained groups of points 27 and 28 ~~along~~ alone. Accordingly, as shown in FIG. 7D, the groups of points 27 and 28 shown in FIGS. 7B and 7C are combined in a same/single coordinate system. Thereby, a group of points 29 by which a three-dimensional shape of the subject 20 can be specified can be obtained.

Please replace the paragraph at page 36, prenumbered lines 14-21, with the following rewritten paragraph:

The above-mentioned composing operation will now be described in more detail. Specifically, an example in which two sets of three-dimensional positional data obtained through taking a picture of the subject 20 from the viewpoints DB and DC shown in FIG. 7A will now be described. However, it is also possible to combine more than two sets of three-dimensional positional data.

Please replace the paragraph at page 36, prenumbered line 22, to page 37, line 3, with the following rewritten paragraph:

With regard to taking a picture from the viewpoint DB, assuming that a rotational angle (B_x , B_y , B_z) around the XYZ axes shown in FIG. 6 from a basic attitude is given, a rotational matrix RB for coordinate conversion from this basic attitude into the attitude of the viewpoint DB is expressed by the following formula (20):

Please replace the paragraph at page 37, prenumbered lines 11-17, with the following rewritten paragraph:

Similarly, with regard to taking a picture from the viewpoint DC, assuming that a rotational angle (C_x , C_y , C_z) around the XYZ axes shown in FIG. 6 from a basic attitude is given, a rotational matrix RC for coordinate conversion from this basic attitude into the attitude of the viewpoint DC is expressed by the following formula (21):

Please replace the paragraph at page 38, prenumbered line 20, to page 39, prenumbered line 1, with the following rewritten paragraph:

For this purpose, points corresponding to one another between the two images obtained from picture taking ~~operation~~ operations from the viewpoint DB and viewpoint DC are found out. For example, in both images shown in FIGS. 8A and 8B, points DD1 and DD2 correspond to one another, and points DE1 and DE2 correspond to one another.

Please replace the paragraph at page 44, prenumbered lines 11-15, with the following rewritten paragraph:

As a method of the above-mentioned interpolation, any conventional method such as that employing a spline function for obtaining an approximation curve connecting such a group of points, or the like, can be employed.

Please replace the paragraph at page 44, prenumbered line 16, to page 45, prenumbered line 3, with the following rewritten paragraph:

Further, the above-mentioned interpolation processing part 50 may also perform correction processing as will now be described. That is, when an erroneously processed point

PF is found out which is obviously discrete from a group of points ~~of a group of points~~ included in an image 39 obtained, as shown in FIG. 15A, a user may specify this point PF by a pointer (indicated by an arrow in the figure) through a mouse operation, and, then, move it to a desired position, or delete it. Thus, it is possible to correct the erroneously processed point PF. Then, by performing this correction processing, it is possible to obtain a proper image 41 shown in FIG. 15B.

Please replace the paragraph at page 48, prenumbered lines 2-8, with the following rewritten paragraph:

Accordingly, according to the shape measurement system 45 in the third embodiment, by combining ~~thus-obtained~~ all of the plurality of sets of three-dimensional positional data thus-obtained into a single coordinate system, it is possible to improve the accuracy of a finally obtained three-dimensional shape of the subject.